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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/689,979	10/20/2003	Joseph Smart	2867-207	3803

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EXAMINER	
DOAN, THERESA T	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 06/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

A·A

Office Action Summary	Application No.	Applicant(s)	
	10/689,979	SMART ET AL.	
	Examiner	Art Unit	
	Theresa T. Doan	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 April 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14 and 17-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *13,14 and 17-21* is/are allowed.

6)☒ Claim(s) *1-7 and 9-12* is/are rejected.

7)☒ Claim(s) *8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 5-7, 9 and 11-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Teraguchi et al. (U.S. 6,177,685) as previously cited.

Regarding claims 1-2 and 11, Teraguchi (figures 1 and 7) discloses a high voltage gallium nitride (GaN) transistor structure (column 1, lines 5-19) comprising:

a) a substrate 1;

b) a plurality of epitaxial layers (column 3, lines 39-42) deposited on the substrate and comprising:

i) a transitional layer (not shown, see column 8, lines 8-11) deposited above the substrate 1;

ii) a sub-buffer (AlN) layer 2/32 (column 3, line 30 or column 7, lines 3-5) deposited above the transitional layer and adapted to prevent electrons from entering the transitional layer and the substrate during high voltage operation (column 7, lines 35-41); and

iii) a GaN buffer layer 3/33 deposited above the sub-buffer layer 2 (column

3, line 31 or column 7, lines 5-7); and

c) electrical contacts 7/8 deposited on the plurality of epitaxial layers, thereby forming a high electron mobility transistor (column 7, lines 10-12).

It is noted that where the claimed and prior art products are identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. In re Best, 195 USPQ 430, 433 (CCPA 1977). It also has been held that products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). In this case, the sub-buffer (AlN) layer 2/32 would inherently have properties of adapted to increase a source-drain breakdown voltage of the GaN transistor structure because the sub-buffer layer 2/32 is made of AlN which is the same as the sub-buffer as claimed.

Regarding claim 13, Teraguchi (figures 1 and 4) discloses a gallium nitride (GaN) transistor structure (column 1, lines 5-19) comprising:

a) a substrate 1;

b) a plurality of structural epitaxial layers deposited on the substrate and includes a GaN buffer layer 3/12 (column 3, lines 31-32 or column 4, lines 66-67);

c) a GaN termination layer 14 (see figure 4, column 5, line 2) deposited on the plurality of structural epitaxial layers and adapted to protect the plurality of structural

epitaxial layers from surface reactions wherein the GaN termination 14 is sufficiently thin to allow electrons to tunnel through the GaN termination layer (column 5, lines 30-40) and is approximately about 1 nanometers (nm) thick (column 5, lines 2-3); and

d) electrical contacts (8,7) deposited on the GaN termination layer, thereby forming a high electron mobility transistor (column 5, lines 5-7).

Regarding claims 3 and 19, Teraguchi (figures 1 and 7) discloses the plurality of epitaxial layers further comprise an Schottky layer 5 deposited above the GaN buffer layer 3.

Regarding claim 5, Teraguchi (figures 1 and 4) discloses wherein the plurality of epitaxial layers further comprise a GaN termination layer 6/15 (column 3, line 37) deposited above the Schottky layer 5 and adapted to protect the Schottky layer from surface reactions.

Regarding claim 6, Teraguchi discloses that the GaN termination layer 6/15 is further a reproducible termination layer (column 3, lines 37-38). It is noted that where the claimed and prior art products are identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. In re Best, 195 USPQ 430, 433 (CCPA 1977). It also has been held that products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties

are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). In this case, the GaN termination layer 6 would inherently has properties of increasing effectiveness of passivation because the termination layer is made of GaN which is the same as the termination layer as claimed.

Regarding claim 7, Teraguchi discloses that the GaN termination layer 15 has a thickness of 10 nm (column 5, lines 64-66), which is sufficiently thin to allow electrons to tunnel through the GaN termination layer.

Regarding claim 9, Teraguchi (figures 1 and 7) discloses the contacts comprise a source contact 8, a gate contact 7, and a drain contact 8, further wherein the source, gate, and drain contacts are metallic (column 5, lines 5-6).

Regarding claim 12, Teraguchi (figure 10) discloses a high voltage gallium nitride (GaN) transistor structure (column 1, lines 5-19) comprising: a substrate 301; a transitional layer (not shown, see column 8, lines 8-11) deposited above the substrate; a sub-buffer layer 302 deposited above the transitional layer; a GaN buffer layer 303 deposited above the sub-buffer layer 302 (column 1, lines 50-59); an aluminum nitride Schottky layer 304 deposited on the gallium nitride buffer layer 303; and a GaN termination layer 305 deposited on the Schottky layer 304 (column 1, lines 50-59).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-7 and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. (U.S. 6,624,452) in view of Teraguchi et al. (U.S. 6,177,685) as previously cited.

Regarding claims 1-2 and 11, Yu (figure 1) discloses a high voltage gallium nitride (GaN) transistor structure (column 2, line 62) comprising:

a substrate 12; a plurality of epitaxial layers (column 4, lines 34-42) deposited on the substrate and comprising: a transitional (or nucleation) layer 14 (column 2, line 64) deposited above the substrate; a GaN buffer layer 16 deposited above the substrate (column 3, lines 32-33); and electrical contacts deposited on the plurality of epitaxial layers, thereby forming a high electron mobility transistor (column 2, lines 1-3).

Yu does not teach more than one buffer layer deposited above the transitional layer.

However, Teraguchi (figure 1) as discussed above, teaches an AlN sub-buffer layer 2 and GaN buffer layer 3 (column 3, lines 30-31) deposited above the transitional layer and adapted to increase a source-drain breakdown voltage of the GaN transistor structure by preventing electrons from entering the transitional layer and the substrate during high voltage operation (column 7, lines 35-41). Furthermore, it has been held that

mere duplication of the essential working parts of a device involves only routine skill in the art. **St. Regis Paper Co. v. Bemis Co., 193 USPQ 8**. Therefore, it would have been obvious to form one or more buffer layers in Yu's device because they both provide the same result of preventing carriers from flowing into the substrate during high voltage operation, as taught by Teraguchi (column 7, lines 35-41).

Regarding claims 3-4, Yu (figure 1) discloses the plurality of epitaxial layers further comprise a Schottky layer 18 deposited above the GaN buffer layer 16 wherein the Schottky layer is essentially aluminum gallium nitride (column 4, lines 15-16).

Regarding claim 5, Yu (figure 1) discloses wherein the plurality of epitaxial layers further comprise a GaN termination layer 22 (column 3, line 67) deposited above the Schottky layer 18 and adapted to protect the Schottky layer from surface reactions (column 4, lines 1-14).

Regarding claim 16, Yu discloses that the GaN termination layer 20 is further a reproducible termination layer (column 3, lines 7-31). It is noted that where the claimed and prior art products are identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. In re Best, 195 USPQ 430, 433 (CCPA 1977). It also has been held that products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties are

inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). In this case, the GaN termination layer 20 would inherently has properties of increasing effectiveness of passivation because the termination layer is made of GaN which is the same as the termination layer as claimed.

Regarding claim 7, Yu (figure 1) discloses the GaN termination layer 22 having a thickness of about 10 nm (see column 5, TABLE B), which is sufficiently thin to allow electrons to tunnel through the GaN termination layer.

Regarding claim 9, Yu (figure 1) discloses the contacts comprise a source contact 24, a gate contact 28, and a drain contact 26, further wherein the source, gate, and drain contacts are metallic (column 3, lines 27-31).

Regarding claim 10, Yu does not disclose a source-drain breakdown voltage which is at least 100 volts. However, it would have been obvious to have a gallium nitride based HFET of Yu for operating at a source-drain breakdown voltage at least 100 volts because as is well known, HFET is a high power transistor which operates at a high voltage level.

Regarding claim 12, Yu (figure 1) discloses wherein the plurality of epitaxial layers further comprise: an aluminum nitride Schottky layer 18 deposited on the gallium

nitride buffer layer 16; and a GaN termination layer 22 deposited on the Schottky layer 18 (column 3, lines 63-67).

5. Claims 1-7 and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Micovic et al. (U.S. Pub. 2003/0218183) in view of Teraguchi et al. (U.S. 6,177,685) as previously cited.

Regarding claims 1-2 and 11, Micovic (figure 18a) discloses a high voltage gallium nitride (GaN) transistor structure comprising:

a substrate 1800; a plurality of epitaxial layers deposited on the substrate and comprising: a transitional (or nucleation) layer 1802 deposited above the substrate; a GaN buffer layer 1804 deposited above the substrate; and electrical contacts deposited on the plurality of epitaxial layers, thereby forming a high electron mobility transistor (see figure 13, paragraph [0072]).

Micovic does not teach more than one buffer layer deposited above the transitional layer.

However, Teraguchi (figure 1) as discussed above, teaches an AlN sub-buffer layer 2 and GaN buffer layer 3 (column 3, lines 30-31) deposited above the transitional layer and adapted to increase a source-drain breakdown voltage of the GaN transistor structure by preventing electrons from entering the transitional layer and the substrate during high voltage operation (column 7, lines 35-41). Furthermore, it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. **St. Regis Paper Co. v. Bemis Co., 193 USPQ 8**. Therefore, it would have been

obvious to form one or more buffer layers in Micovic's device because they both provide the same result of preventing carriers from flowing into the substrate during high voltage operation, as taught by Teraguchi (column 7, lines 35-41).

Regarding claims 3-4, Micovic (figure 18a) discloses the plurality of epitaxial layers further comprise a Schottky layer 1808 deposited above the GaN buffer layer 16804 wherein the Schottky layer is essentially aluminum gallium nitride.

Regarding claim 5, Micovic (figure 18a) discloses wherein the plurality of epitaxial layers further comprise a GaN termination layer 1810b deposited above the Schottky layer 1808 and adapted to protect the Schottky layer from surface reactions (see paragraphs from [0089] to [0091]).

Regarding claim 6, Micovic discloses that the GaN termination layer 1810b is further a reproducible termination layer (see paragraph [0089], line 7). It is noted that where the claimed and prior art products are identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. In re Best, 195 USPQ 430, 433 (CCPA 1977). It also has been held that products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re

Spada, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). In this case, the GaN termination layer 1810a would inherently has properties of increasing effectiveness of passivation because the termination layer is made of GaN which is the same as the termination layer as claimed.

Regarding claim 7, Micovic (figures 13 and 18a) discloses the GaN termination layer 1810b is approximately 10 nanometers (nm) thick (see figure 18, paragraph [0089]) that is sufficiently thin to allow electron to tunnel through the GaN termination layer.

Regarding claim 9, Micovic (figure 13) discloses the contacts comprise a source contact 1202, a gate contact 1308, and a drain contact 1204, further wherein the source, gate, and drain contacts are metallic (see paragraph [0070]).

Regarding claim 10, Micovic does not disclose a source-drain breakdown voltage which is at least 100 volts. However, it would have been obvious to have a gallium nitride based HFET of Yu for operating at a source-drain breakdown voltage at least 100 volts because as is well known, HFET is a high electron mobility transistor which operates at a high voltage level.

Regarding claim 12, Micovic (figure 18a) discloses wherein the plurality of epitaxial layers further comprise: an aluminum nitride Schottky layer 1808 deposited on

the gallium nitride buffer layer 1804; and a GaN termination layer 1810b deposited on the Schottky layer 1808.

Allowable Subject Matter

6. Claim 8 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record fails to disclose the combination of a high voltage gallium nitride transistor structure comprising: the GaN termination is approximately 1-2 nm thick.

7. Claims 13-14 and 17-21 are allowed.

Response to Arguments

8. Applicant argues that Applied references fail to disclose the AlN buffer layer operates to increase a source-drain breakdown voltage of the GaN transistor structure and increasing the source-drain breakdown voltage is not inherent in the structure of Teraguchi.

This argument is not persuasive because as discussed in the office action above, it is noted that where the claimed and prior art products are identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. In re

Best, 195 USPQ 430, 433 (CCPA 1977). It also has been held that products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). In this case, the sub-buffer of the Applied references would inherently have properties of adapted to increase a source-drain breakdown voltage of the GaN transistor structure because the sub-buffer layer is made of AlN which is the same as the sub-buffer as claimed. The burden is shifted to Applicant to show that why the sub-buffer of AlN layer of Applicant can function as adapted to increase a source-drain breakdown voltage of the GaN transistor structure, but the sub-buffer layer of the same AlN material of the applied prior art cannot function as adapted to increase a source-drain breakdown voltage of the GaN transistor structure. In the other words, if Applicant belies that the sub-buffer of AlN layer of the applied prior art cannot function as adapted to increase a source-drain breakdown voltage of the GaN transistor structure, then Applicant is requested to support that position with facts.

The rest of applicant's arguments, addressed to the amended claims are considered in the rejections shown above.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Theresa T. Doan whose telephone number is (571) 272-1704. The examiner can normally be reached on Monday to Friday from 7:00AM - 4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WAEL FAHMY can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TD
June 21, 2005.

PHAT X. CAO
PRIMARY EXAMINER